

Cementitious Encapsulation and Solidification for Solid Secondary Waste: Technology and Performance Assessment for Low-Activity Waste

PARTNERS



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Hanford Site/Office of River Protection

Technical Summary

This project is focused on accelerating the development of a robust low-level waste (LLW) cementitious encapsulation technology for solid secondary wastes (SSW), including waste streams from the Hanford Tank Waste Treatment and Immobilization Plant (WTP). Despite its relatively small footprint, SSW will be the largest risk driver for the Hanford Integrated Disposal Facility (IDF). A robust waste form design for SSW that satisfies the IDF permitting process is a necessary condition for startup of the WTP vitrification operations for Hanford low-activity waste. The IDF will receive cement-encapsulated SSW including debris waste, melter consumables, failed process components, silver mordenite beds, ion exchange resins, carbon adsorbent, and HEPA filters that are to be packaged and stabilized (grouted). The Swiss radioactive waste management agency, Nagra, has similar solid waste streams that are being encapsulated in cement and placed in steel drums. Nagra solid waste encapsulation, stabilization, and containment technology is based on over 20 years of development and testing: lab-, intermediate-, and in situ field-scale experiments; sorption databases and geochemical evolution studies for the cementitious near-field; post-disposal gas phase analyses; and modeling of long-term mineral reactions with feedback to porosity and permeability. Collaboration with the Swiss program and familiarity with their strategy, design, and implementation; testing and analytical methods; and performance assessment modeling approaches will provide for more expeditious development of a robust and technically defensible Hanford solid secondary waste form.

Path Forward

- Familiarize Nagra with the Hanford cementitious SSW approach and opportunities to address data, knowledge, and technology needs.
- Review Nagra guidance on the development of formulations for cementitious materials and the testing and experimental program for waste form performance.
- Perform reciprocal modeling studies in support of laboratory experiments on cement-encapsulated polystyrene-based ion exchange resins.
- Work with Hanford (Office of River Protection) to develop and implement a plan for knowledge and technology insertion into the cementitious SSW form design process.



Stacked containers with low- and intermediate-level waste in storage building in Würenlingen, Switzerland.

Key Accomplishments

- Initial technical exchange provided Hanford with descriptions of Nagra 1) low- and intermediate-level cementitious waste form, 2) long-term cementitious material degradation studies, and 3) waste stream-specific experimental data.
- Hanford and Savannah River SSW teams prepared an overview of current Hanford cementitious SSW data, knowledge, and technology that included a request for specific information from Nagra to help address current gaps.
- Nagra provided design types and methods for SSW macro-encapsulation and blending; cementitious waste form characterization and testing, including contaminant release properties.

Key Benefits

- Helps address a high priority requirement for Hanford Tank WTP operation: design of the cementitious waste form for the solid secondary waste streams.
- Leverages Nagra research, experience, and insights in SSW streams to accelerate the ongoing development of 1) a robust LLW cementitious encapsulation technology, and 2) a defensible long-term modeling approach for performance assessment.
- Technical exchange and collaboration with the Swiss radioactive waste disposal program will help EM cost-effectively meet milestones for SSW immobilization for the IDF by following the most promising lines of technology development and avoiding less successful approaches that have already been tried.

